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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/035,018	12/27/2001	Emile Di Serio	1759.066	9212

7590 07/20/2007

HESLIN ROTHENBERG FARLEY & MESITI, P.C.
5 Columbia Circle
Albany, NY 12203

EXAMINER	
SUHOL, DMITRY	
ART UNIT	**PAPER NUMBER**
3725	

MAIL DATE	DELIVERY MODE
07/20/2007	PAPER

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/035,018
Filing Date: December 27, 2001
Appellant(s): SERIO, EMILE DI

Victor A. Cardona
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 3/20/2007 appealing from the Office action mailed 10/20/2006.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

JP 07-195136	MIKITO	08-1995
JP 05-146841	HIROSHI	06-1993

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

1. Claims 1 and 3 are again rejected under 35 U.S.C. 103(a) as being unpatentable over Mikito in view of admitted prior art and Hiroshi.

Mikito Figure 6 discloses the use of cylinder-type control means 40 for introduction of a multidirectional rod 38 into a workpiece cavity prior to forging and withdrawal of the rod subsequent to forging, as required by the claims. Example 4 and Figures 8 and 9 of Mikito disclose a molding foundry preform 50 having cavities 51, 52 In subsequent forging, tools 64, 65 are inserted in cavaties whereby the product is formed with recesses 71, 72. It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide such control means to insert and withdraw the multidirectional rods 63, 64 in Mikito Figure 8 in order to avoid the need for manual manipulation of cumbersome and/or heavy tool elements.

Mikito further advises that the perform may require heating between molding and forging. On page4, lines 10 to 19, of the specification it is admitted prior art to reheat a molded preform in a tunnel furnace prior to forging in order to ensure a uniform temperature. It would have been obvious to one having ordinary skill in the art at the time of the claimed invention, to preform the reheating suggested by Mikito with a tunnel furnace, following the teaching of the admitted prior art, in order to ensure a uniform temperature at the time of forging.

Hiroshi discloses forging a molded a preform 60 having cavities 22, 24. In subsequent forging the shape of molded cavities is maintained by rods 52. It would have been obvious to maintain the shape of cavities of the molded preform in the forging of Mikito since whether the shape of the preformed cavities is reformed during

the forging, as shown in Figures 8 and 9 of Mikito, or maintained in the molded shape, as in Hiroshi, is considered to be an obvious exercise of mechanical design depending on the complexity and location of the cavity profile desired in the product, and not a patentable distinction absent a disclosure of criticality in the solution of stated problems with the formation of a molded cavity and subsequent product recess having a specific profile. It would be particularly obvious to form a molded cavity having the desired final profile in an instance where subsequent forging is applied at a perform location which is remote from the location of the cavity, as shown by Hiroshi Figures 3 and 4 where the cavities are adjacent one end of the molded perform and the heading is performed adjacent the other end.

The molded preform forged in Mikito is considered to be a solid, as recited in Claim 3, since it is a self-sustaining shape. It is noted that Appellant has no disclosure of specific conditions of the molded preform in the forging operation. In addition, Hiroshi clearly shows that the molded preform may be "solid" when forged.

Claim Rejections - 35 USC § 102

2. Claims 2 and 4 are rejected under 35 U.S.C. 102(b) as being anticipated by Mikito.

Figure 6 of Mikito discloses a forging die having cylinder-type control means 40 for translating a multidirectional rod 38 into a preformed workpiece cavity 34, as required by these claims. Whether the workpiece cavity is reshaped in the forging or

maintained in shape, as required by Claim 1, is immaterial in a claim to the die itself since the die structure is not limited by the characteristics of the forging perform.

(10) Response to Argument

Appellants first argument starts at the bottom of page 3 and continues thru page 4, where it is argued that there is no disclosure of at least one shape of at least one recess and a cavity of a preform being substantially maintained by a multi-directional rod during a heading operation, nor is there disclosure of at least one multi-dimensional rod being introduced into preform recesses or cavity by a control means according to a command prior to a heading operation nor such a rod being with drawn by such control means after the heading operation. In response the examiner points out that as shown in figures 6, 8 and 9, and admitted to by the Appellants at page 4 of the Brief, cavities 51 and 52 are created in a first step as shown in figure 6 after which rods 63 and 64 are inserted into cavities 51 and 52 and the preform is compressed by a die 62 forming cavities 71 and 72 around rods 63, 64 after which the rods are removed to and the fabrication is completed (see paragraph 0028 of translation). Thus rods 63, 64 serve to substantially maintain the shape of the cavities, however Hiroshi is further introduced to teach that it is known to provide a preform forged product 60 having cavities 22, 24 with an insert rod element 52 during a heading/forging step in order to substantially maintain the cavity shape depending on the desired shape of the final product and complexity of said final product. Regarding a control means, as claimed by the Appellants, Mikito teaches the use of a hydraulic oil cylinder (40) to move a rod in and out of the substrate

in figure 6, where the Appellants at page 4, lines 35-36 disclose that they claimed control means is a simple cylinder (like that disclosed by Mikito) or any other controller. Therefore, it is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide such control means to insert and withdraw the multidirectional rods 63, 64 of Mikito (Figure 8) in order to avoid the need for manual manipulation of cumbersome and/or heavy tool elements and to automate the process, especially since it has been held that broadly automating a formerly manual process is not sufficient to distinguish over the prior art. *In re Venner*, 262 F.2d 91, 95, 120 USPQ 193, 194 (CCPA 1958).

At the top of page 5, Appellants further argue that Hiroshi fails to address a multi-directional rod being inserted into a recess or cavity of during a heading operation no the introduction of such a rod by a control means according to a command prior to the heading operation and the removal of such a rod after the heading operation by the control means since the insert of Hiroshi remains in the core during the casting and forging phase. In response the examiner points out that Hiroshi is merely relied upon to teach the use of inserts in a heading/forging step of a metal substrate which is inserted into a cavity to substantially hold the shape of the cavity during the processing step. In other words, the examiner is proposing that the shape of rods 63 and 64 be such that a constant shape is substantially maintained of the cavities produced when the perform is manufactured as such would only depend on the desired final product and complexity thereof.

At the middle of page 5, the Appellants further argue that the construction of the Hiroshi insert 50 is such that it teaches away from heating the perform in a furnace as the insert would be damaged. In response the examiner points out that it is not suggested the inserts 63, 64 of Mikito be modified to an insert of Hiroshi but rather that the shape of inserts 63 and 64 be such that the shape of the cavities of Mikito are substantially maintained.

Starting at the bottom of page 5 and into page 6, it is once again argued that neither reference discloses a control means as claimed, nor is there reason to insert and remove a multi-direction rod after the heading operation by a control means. In response the examiner points out that it is not the Hiroshi reference which is being modified and insertion and subsequent removal of insert 50 in the teachings of Hiroshi is not germane to the rejection, but rather rods 63 and 64 of Mikito are inserted and withdrawn as claimed (see last two lines of paragraph 0028 of translation of Mikito), while the control means and reasons for incorporating such a control with the rods are obvious as stated above.

At the bottom of page 6, it is argued that there is no disclosure, teaching or suggestion that the perform is transferred to a tunnel furnace as claimed and since the metal of Mikito is semi-liquid there is no reason to believe that placing the perform in a furnace would provide any benefit. It is also argued that if the perform of Hiroshi was put through such a furnace then insert 50 would be destroyed. In response the examiner points out that Mikito suggests that his preform is heated between the steps of figure 6 and 8 (see translation, paragraph 0028) therefore taking applicants admission that it is

known to use tunnel furnaces to heat a preform to ensure a uniform temperature (page4, lines 10 to 19, of the specification) along with Mikito's suggestion of heating the perform, the use of a tunnel furnace to heat the perform of Mikito would have been obvious for the purpose of ensuring a uniform temperature at the time of forging and the desired consistency of the metal substrate.

At the top of page 7 it is argues that there is no reason to combine the references of Mikito and Hiroshi. In response the examiner points out that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, both references are concerned with forged metal products, while Hiroshi's use of a insert 50 which allows the shape of cavities 22 and 24 to substantially remain unchanged during a forging step is an improvement over the prior art in that it allows for a easy, inexpensive forging process of a metallic part having a complex shape without a reduction in strength (see purpose of Hiroshi in abstract).

At page 8 thru page 9, it is argued that Mikito does not disclose all claimed elements. Specifically, it is argued that there is no control means including a rod translation mechanism which is positioned around a heading die receiving a foundry perform. In response it is pointed out that claim 2 is a product claim and therefore the method steps of parent claim 1 do not serve to patentably distinguish the claim. The

structural limitations are all encompassed in Mikito (figure 6), for example, a multidirectional rod is shown as member 38, a heading die is shown as die 35, while the control means is shown as oil cylinder 40. Therefore, claims 2 and 4 are anticipated by Mikito.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Dmitry Suhol

Primary Examiner

Art Unit 3725

Conferees:

Derris Banks, SPE

Boyer Ashley, SPE

Dmitry Suhol, Primary Examiner

EUROPEAN PATENT OFFICE

Patent Abstracts of Japan

PUBLICATION NUMBER : 05146841
PUBLICATION DATE : 15-06-93

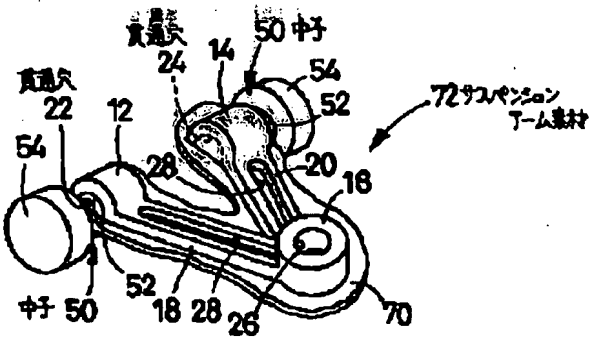
APPLICATION DATE : 27-11-91
APPLICATION NUMBER : 03337595

APPLICANT : TOYOTA MOTOR CORP;

INVENTOR : MAKINO HIROSHI;

INT.CL. : B21J 5/00 B21J 5/02 B22D 19/00

TITLE : FORGING METHOD



ABSTRACT : PURPOSE: To obtain a method for forging easily and inexpensively an article having an undercut part while avoiding reduction of strength.

CONSTITUTION: Internal chill casting is performed by an casting machine where a core 50 is arranged in a cavity and the cast article is forged by a forging machine. Each core 50 is extracted from the boss parts 12, 14 of a forged suspension arm material to form through holes 22, 24. Since a higher yield of material is obtained than that obtained when through holes 22, 24 are formed by boring after forging and a grain flow generated by forging is not cut, the reduction of mechanical strength of suspension arm is prevented. An ordinary casting machine and a forging machine can be used and an inexpensive equipment can be used.

(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（Ａ）　(11)特許出願公開番号

特開平5－146841

(43)公開日　平成５年(1993)６月15日

(51)Int.Cl.⁵		識別記号	庁内整理番号	Ｆ１	技術表示箇所
Ｂ２１Ｊ	5/00	Ｂ	6778－4Ｅ		
	5/02	Ｄ	6778－4Ｅ		
Ｂ２２Ｄ	19/00	Ｐ	9266－4Ｅ		

審査請求　未請求　請求項の数１(全　４　頁)

(21)出願番号　特願平3－337595

(22)出願日　平成３年(1991)11月27日

(71)出願人　000003207
トヨタ自動車株式会社
愛知県豊田市トヨタ町１番地

(72)発明者　牧野　浩
愛知県豊田市トヨタ町１番地　トヨタ自動車株式会社内

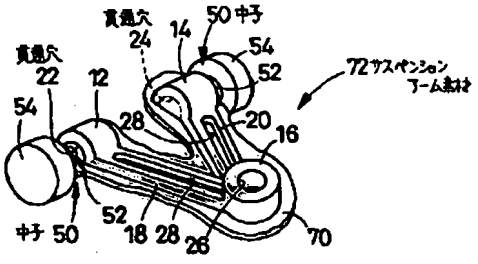
(74)代理人　弁理士　神戸　典和　(外２名)

(54)【発明の名称】　鍛造方法

(57)【要約】

【目的】　アンダカット部を有する鍛造品を、強度の低下を回避しつつ容易かつ安価に鍛造する方法を得る。

【構成】　キャビティ内に中子５０を配置した鋳造装置により鋳ぐるみ鋳造を行い、その鋳造品を鍛造装置により鍛造する。鍛造後のサスペンションアーム素材７２のボス部１２，１４から各中子５０を引き抜くことにより、貫通穴２２，２４を形成する。鍛造後に穴あけ加工により貫通穴２２，２４を形成する場合に比較して、材料歩留まりが向上するとともに、鍛造により生じる鍛流線が切断されることがないため、サスペンションアームの機械的強度の低下が防止される。また、通常の鋳造装置および鍛造装置を用いることができ、装置コストが低くて済む。



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【特許請求の範囲】

【請求項1】　金属材料をほぼ鍛造品形状に鋳造した後、その鋳造品を鍛造して鍛造品を得る方法であって、鍛造品のアンダカット部に対応する部分に中子を配置して鋳ぐるみ鋳造し、その中子を鋳ぐるんだ鋳造品を鍛造した後中子を除去することを特徴とする鍛造方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は鍛造方法に関するものであり、特に、金属材料を鋳造した後鍛造する方法に関するものである。

【0002】

【従来の技術】鍛造方法の一種に、金属材料をほぼ鍛造品形状に鋳造した後その鋳造品を鍛造する方法がある。例えば、特開昭62－187539号公報には、アルミ鋳造品を鍛造する方法が記載されている。このようにほぼ鍛造品形状の鋳造品を鍛造することにより、鍛造のみを行う場合に比較して容易に所望の形状の鍛造品を得ることができる。また、鍛造品形状に沿って鍛造品の内部に生じる鍛流線の形成により、機械的強度に優れた製品を得ることができる。

【0003】

【発明が解決しようとする課題】しかしながら、鍛造品がアンダカット部を有する場合には、中実の鋳造品を形成して鍛造を施した後、その鍛造品に穴あけ加工や切削加工等によりアンダカット部を形成していたため、工数が増えるとともに材料歩留まりが低下し、コストが高くなるという問題があった。また、鍛造品に穴あけ加工等を施すことにより鍛流線が切断されるため、機械加工後の製品の強度が低下してしまうという問題もあった。

【0004】一方、鋳型にアンダカット成形部を設けることにより、アンダカット部を有する鋳造品を形成し、その鋳造品を複数段階に分けて鍛造することも行われていたが、鍛造工程数が増大して能率が低下する上、鍛造設備費が上昇して望ましくない。

【0005】本発明は上記問題に鑑み、アンダカット部を有する鍛造品を容易にしかも安価に鍛造し得る方法を得ることを課題として成されたものである。

【0006】

【課題を解決するための手段】そして、本発明の要旨は、鍛造品のアンダカット部に対応する部分に中子を配置して鋳ぐるみ鋳造し、その中子を鋳ぐるんだ鋳造品を鍛造した後中子を除去することにある。

【0007】

【作用】中子が鋳ぐるまれた状態の鋳造品は中実の鋳造品と同様に鍛造し得、鍛造後に中子を除去すればアンダカット部を有する鍛造品を得ることができる。

【0008】

【発明の効果】したがって、従来のようにアンダカット部を形成するために鍛造品に穴あけ加工等を施す必要がなく、工数が減るとともに材料歩留まりが向上する効果が得られる。また、鍛流線を切断せずに済むため、機械加工後の製品の強度低下を防止することができ、鍛造後にアンダカット部を切削加工で形成する場合に比較して、衝撃値，引張強さ，耐力，伸び等の機械的強度に優れた製品を得ることができる。さらに、一般の鋳造装置および鍛造装置を使用することができ、鍛造工程数も少なくて済むため、装置コストを低く抑えることができる。

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【0009】

【実施例】以下、本発明をアルミニウム合金製のA形サスペンションアームの鍛造方法に適用した場合の一実施例を図面に基づいて詳細に説明する。図5に示すように、製品たるサスペンションアーム10は、3つのボス部12，14および16を備えており、ボス部12とボス部16とが連結部18により、ボス部14とボス部16とが連結部20によりそれぞれ連結されてほぼA形を成している。ボス部12，14にはそれぞれほぼ水平方向に延びる貫通穴22，24が形成されており、ボス部16にはほぼ垂直方向に延びる段付の貫通穴26が形成されている。また、両連結部18，20にはそれぞれ長手方向に延びる溝28が形成されている。

【0010】図2において、30は鋳造装置の金型である。金型30は上型32および下型34から成っており、両型32，34によりキャビティ36が形成される。キャビティ36はほぼサスペンションアーム10の形状を成している。上型32には湯道38が形成されており、金属溶湯が湯道38からキャビティ36内へ流し込まれるようになっている。

【0011】また、図4において、42は鍛造装置の上型であり、44は下型である。上型42は図示しない駆動装置により下型44に接近・離間させられ、両型42，44の型面46，48により鍛造が行われる。

【0012】以下、サスペンションアーム10の鍛造方法について説明する。ボス部12，14の貫通穴22，24はアンダカット部であるため、まず、図2に示すように、金型30のキャビティ36に2個の中子50を配置する。これら中子50は合金工具鋼材SKD61等の金属から成り、外周面がわずかにテーパ状とされた成形部52を備えている。中子50の成形部52の外周面に黒鉛系の離型剤を塗布した後、サスペンションアーム10の貫通穴22，24に対応する部分に成形部52をそれぞれ位置させ、大径の幅木54（図1，図3参照）により保持させる。

【0013】次に、図示しない給湯装置から湯道38を経てキャビティ36内へアルミニウム合金の溶湯を流し込み、鋳造を行う。

【0014】鋳造後、上型32および下型34を離間させて鋳造品60を取り出し、方案部を除去する。図3に示すように、鋳造品60のボス部62，64にはそれぞ

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れ中子５０の成形部５２が鋳ぐるまれている。この状態ではボス部６６には凹部は形成されておらず、連結部６６，６８にも溝は形成されていない。

【００１５】次に、図４に示す鍛造装置の下型４４上に中子５０を鋳ぐるんだ鋳造品６０を載置し、駆動装置により上型４２を上下動させて鍛造を行う。鍛造に伴って、両型面４６，４８により、ボス部６６に貫通穴２６が形成されるとともに、連結部６６，６８にそれぞれ溝２８が形成される。

【００１６】鍛造直後のサスペンションアーム素材（鍛造品）７２を図１に示す。図から明らかなように、鍛造によってサスペンションアーム素材７２の周囲に余肉によるバリ７０が生じる。このバリ７０により一時的に中子５０の成形部５２が覆われるが、差し支えない。

【００１７】鍛造後のサスペンションアーム素材７２を鍛造装置から取り出した後、ボス部１２，１４からそれぞれ中子５０を引き抜く。中子５０の成形部５２はわずかにテーパ状とされており、しかも離型剤が塗布されているため、容易に引き抜くことができる。中子５０が引き抜かれた後に貫通穴２２，２４が形成される。中子５０は耐熱性，耐久性等に優れているため、サスペンションアーム素材７２から引き抜かれた後、次の鍛造時に再利用可能である。

【００１８】その後、図示しないプレス装置によりバリ７０を除去し、機械加工で仕上げることによって、図５に示すサスペンションアーム１０が得られる。

【００１９】なお、本実施例においては、中子５０の成形部５２の先端が、ボス部１２，１４の貫通穴２２，２４から突出しない長さとされていたが、ボス部１２，１４から突出する長さとすることにより、バリ７０により

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成形部５２が覆われないようにすることも可能である。

【００２０】また、鍛造品の形状に応じて中子を押し出して除去してもよく、中子を１回のみ使用する場合には、鍛造品から中子を削り取るようにしてもよい。

【００２１】その他、当業者の知識に基づいて種々の変形，改良を施した態様で、本発明を実施することができる。

【図面の簡単な説明】

【図１】本発明の一実施例である鍛造方法により鍛造された鍛造品を示す斜視図である。

【図２】上記鍛造方法の一工程を概略的に示す正面断面図である。

【図３】上記鍛造方法の一工程により形成された鋳造品を示す斜視図である。

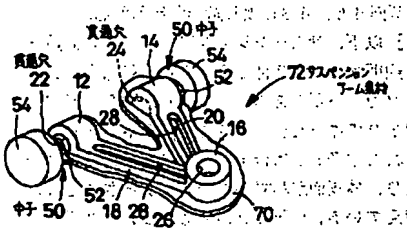
【図４】上記鍛造方法の別の工程を概略的に示す正面断面図である。

【図５】図１の鍛造品に仕上げ加工を施した製品を示す斜視図である。

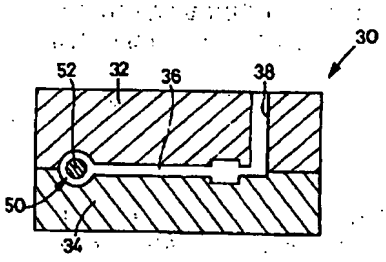
【符号の説明】

１０　サスペンションアーム
２２　貫通穴
２４　貫通穴
３０　金型
３６　キャビティ
４２　上型
４４　下型
５０　中子
６０　鋳造品
７２　サスペンションアーム素材

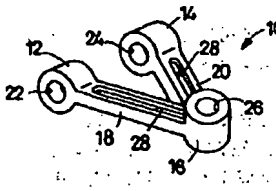
【図１】



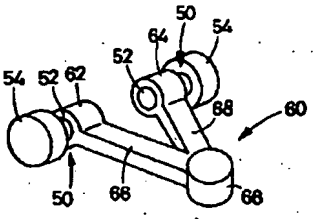
【図２】



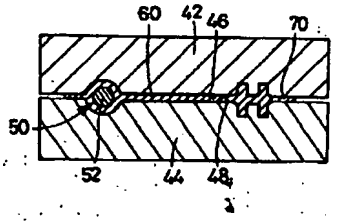
【図５】



【図3】



【図4】



Translation of JP-05-146841

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the approach of forging, after casting a metallic material especially about the forging approach.
[0002]
[Description of the Prior Art] After casting a metallic material in a forging configuration mostly, the approach of forging the cast is in a kind of the forging approach. For example, the approach of forging an aluminum cast is indicated by JP,62-187539,A. Thus, by forging the cast of a forging configuration mostly, the forging of a desired configuration can be easily obtained as compared with the case where it only forges. Moreover, the product excellent in the mechanical strength can be obtained by formation of the flow line produced inside a forging in accordance with a forging configuration.
[0003]
[Problem(s) to be Solved by the Invention] However, since the undercut section was formed in the forging by punching processing, cutting, etc. after forging by forming the cast of a solid when a forging had the undercut section, while the man day increased, the ingredient yield fell, and there was a problem that cost became high. Moreover, since a flow line was cut by performing punching processing etc. to a forging, there was also a problem that the reinforcement of the product after machining will fall.
[0004] Although forming the cast which has the undercut section by preparing the undercut shaping section in mold on the other hand, dividing the cast into two or more steps, and forging it was also performed, when a forging routing counter increases and efficiency falls, a forging installation cost goes up and is not desirable.
[0005] It accomplishes as a technical problem that this invention acquires the approach of forging the forging which has the undercut section easily and cheaply in view of the above-mentioned problem.
[0006]
[Means for Solving the Problem] and the summary of this invention arranges a core into the part corresponding to the undercut section of a forging, carries out insert casting, and is ******** about the core -- it is in removing a core, after forging a cast.
[0007]
[Function] A core can forge the cast of ****** rare ****** like the cast of a solid, and if a core is removed after forging, the forging which has the undercut section can be obtained.
[0008]
[Effect of the Invention] Therefore, in order to form the undercut section like before, while it is not necessary to perform punching processing etc. to a forging and a man day becomes fewer, the effectiveness that the ingredient yield improves is acquired. Moreover, since it is not necessary to cut a flow line, the fall of the product after machining on the strength can be prevented, and the product excellent in mechanical strengths, such as an impact resistance value, tensile strength, proof stress, and elongation, can be obtained as compared with the case where the undercut section is formed by cutting after forging. Furthermore, since common casting equipment and forging equipment can be used, and

there are also few forging routing counters and they end, equipment cost can be held down low.
[0009]
[Example] Hereafter, one example at the time of applying this invention to the forging approach of A form suspension arm made from an aluminium alloy is explained to a detail based on a drawing. As shown in drawing 5 , the product slack suspension arm 10 is equipped with the three boss sections 12, 14, and 16, and the boss section 12 and the boss section 16 were connected by the connection section 18, the boss section 14 and the boss section 16 were connected by the connection section 20, respectively, and it has constituted about A forms. The through holes 22 and 24 prolonged almost respectively horizontally are formed in the boss sections 12 and 14, and the through hole 26 with a stage prolonged mostly perpendicularly is formed in the boss section 16. Moreover, the slot 28 which extends in a longitudinal direction, respectively is formed in both the connection sections 18 and 20.
[0010] In drawing 2 , 30 is the metal mold of casting equipment. Metal mold 30 consists of a punch 32 and female mold 34, and a cavity 36 is formed with both the molds 32 and 34. The cavity 36 has constituted the configuration of a suspension arm 10 mostly. The runner 38 is formed in the punch 32 and a metal molten metal is slushed into a cavity 36 from a runner 38.
[0011] Moreover, in drawing 4 , 42 is the punch of forging equipment and 44 is female mold. It is made to approach and estrange a punch 42 with the driving gear which is not illustrated by female mold 44, and forging is performed by the mold faces 46 and 48 of both the molds 42 and 44.
[0012] Hereafter, the forging approach of a suspension arm 10 is explained. Since the through holes 22 and 24 of the boss sections 12 and 14 are the undercut sections, as shown in drawing 2 , they arrange two cores 50 to the cavity 36 of metal mold 30 first. These cores 50 consisted of the metal of alloy-tool-steel material SKD61 grade, and are equipped with the shaping section 52 by which the peripheral face was slightly made the shape of a taper. After applying the release agent of a graphite system to the peripheral face of the shaping section 52 of a core 50, the shaping section 52 is located in the part corresponding to the through holes 22 and 24 of a suspension arm 10, respectively, and it is made to hold by the core print 54 (to refer to drawing 1 and drawing 3) of a major diameter.
[0013] Next, it casts from the hot-water supply equipment which is not illustrated by slushing the molten metal of an aluminium alloy into a cavity 36 through a runner 38.
[0014] After casting, a punch 32 and female mold 34 are made to estrange, a cast 60 is taken out, and the casting plan section is removed. As shown in drawing 3 , in the boss sections 62 and 64 of a cast 60, the shaping section 52 of a core 50 is ****** rare ******, respectively. In this condition, a crevice is not formed in the boss section 66 and the slot is not formed in the connection sections 66 and 68.
[0015] next, it is ******** about a core 50 on the female mold 44 of the forging equipment shown in drawing 4 -- a cast 60 is laid and it forges by moving a punch 42 up and down with a driving gear. While a through hole 26 is formed in the boss section 66 by both the mold faces 46 and 48 with forging, a slot 28 is formed in the connection sections 66 and 68, respectively.
[0016] The suspension-arm material 72 immediately after forging (forging) is shown in drawing 1 . The weld flash 70 by the excess metal arises around the suspension-arm material 72 with forging so that clearly from drawing. It does not interfere, although the shaping section 52 of a core 50 is temporarily covered with this weld flash 70.
[0017] After picking out the suspension-arm material 72 after forging from forging equipment, a core 50 is drawn out from the boss sections 12 and 14, respectively. The shaping section 52 of a core 50 is slightly made into the shape of a taper, and since the release agent is moreover applied, it can be drawn out easily. After a core 50 is drawn out, through holes 22 and 24 are formed. Since the core 50 is excellent in thermal resistance, endurance, etc., after being drawn out from the suspension-arm material 72, it is reusable at the time of the next forging.
[0018] Then, the suspension arm 10 shown in drawing 5 is obtained by the press equipment which is not illustrated removing weld flash 70, and finishing by machining.
[0019] In addition, in this example, although the tip of the shaping section 52 of a core 50 was made into the die length which does not project from the through holes 22 and 24 of the boss sections 12 and 14, the shaping section 52 is able to be made not to be covered with weld flash 70, either by considering as

the die length which projects from the boss sections 12 and 14.
[0020] Moreover, when a core may be extruded and removed according to the configuration of a forging and it uses a core once, you may make it shave [forging] a core.
[0021] In addition, this invention can be carried out in the mode which performed various deformation and amelioration based on this contractor's knowledge.

[Translation done.]